/SEM -V(CBSGS)/INST/T3425 / T0505 SIGNAL & SYSTEMS /MAY 2017

Q. P. Code : 597800

(3 Hours) **Total Marks: 80**

N.B.: (1) Question no. **1** is **compulsory**

(2) Solve **any three** questions from question no. **2** to question no. **6.**

(3) Assume suitable data if required.

1. Solve any four questions. 20

a) State and prove Parseval's theorem.

b) If $x_1(n)$ & $x_2(n)$ are two periodic sequences given below, find the convolution between them.

$$x_1(n) = (1,-3,0,1) \;\&\; x_2(n) = (1,1,1,0)$$

c) Prove that $\int_{-\infty}^{\infty} x^2(t)dt = \int_{-\infty}^{\infty} x_e^2(t)dt + \int_{-\infty}^{\infty} x_0^2(t)dt$

d) Find the initial value and final value of the following Z-domain signal

$$X(z) = \frac{1}{1 - z^{-2}}$$

e) State all the properties of Laplace transform & derive time shifting property.

2. (a) Find inverse Laplace Transform for all possible ROCs. 10

$$x(s) = \frac{3s + 7}{s^2 - 2s - 3}.$$

(b) Let $x(n) = \delta(n) + 2\delta(n-1)$ & $h(n) = 2\delta(n+1) + 2\delta(n-1)$ compute y(n). 10

3. (a) Determine whether following signals are periodic or not. If periodic, find fundamental period. 4

i. $x[n] = \cos\left(\frac{\pi n}{2}\right) - \sin\left(\frac{\pi n}{8}\right) + 3\cos\left(\frac{\pi n}{4} + \frac{\pi}{3}\right)$

ii. $x(t) = 3\cos\left(5t + \frac{\pi}{6}\right)$

(b) Find whether the signals are Energy or power signal. 6

i. $x(t) = A\, e^{-10t} u(t)$

ii. $X[n] = u[n]$

(c) Sketch a given signal: 10

$$x(t) = 2u(t) - u(t-2) + u(t-4) - r(t-6) + r(t-8)$$

[TURM OVER]

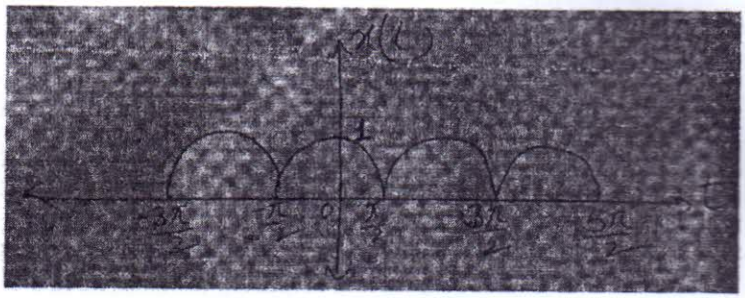
4. (a) Determine whether following systems are static or dynamic, linear or non-linear, time variant or invariant, causal or non causal & stable or unstable. 10

i. $y(t) = x(t) \cos(100\pi t)$

ii. $y(n) = 2x(2^n)$

(b) $y''(t) + 3y'(t) + 2y(t) = x(t)$ with initial conditions $y(0) = 3$, $y'(0) = 4$ find $y(t)$, If $x(t) = 4e^{-2t}u(t)$ 10

5. (a) Find trigonometric Fourier series of following signal 10



(b) Find out Z - Transform and R.O.C. of following signals. 10

i. $x[n] = (0.6)^n u[n] + (0.9)^n u[n]$

ii. $x[n] = 2^n u[n] + 3^n u[-n-1]$

6. (a) State the relationship between Laplace and Fourier transform 4

(b) Find odd and even part of given signal. 6

i. $x(t)=1+t\cos t+t^2\sin t+t^3\sin t.\cos t$

ii. $x(t)=(1+t^3)(\cos^3 10\, t)$

(c) By residue method, find inverse Z.T. of 10

$$X[z] = \frac{(1-e^{-a})z}{(z-1)(z-e^{-a})}$$

INST/SEM-V / T3425 / T0502 APPLICATIONS OF MICROCONTROLLER I / May 2017
(CBSGS)

Q. P. CODE : 597502

(03 Hours) **Total Marks-80**

N.B. : 1) Question No. **1** is **compulsory**.
2) Attempt any **three** questions from **remaining five** questions.
3) Assume suitable **data** wherever necessary.
4) Figure to right indicate **full** marks.
5) Illustrate your answer with neat **sketches** wherever necessary.

1. Attempt **any four** questions- 20
a) Define microprocessor and explain microprocessor based computer system.
b) Draw block diagram of 8051 microcontroller and explain use of I/O ports.
c) Explain Timer2 in "Capture Mode" with neat diagram.
d) Write a program to initialize the serial port to operate as an 8-bit UART at 2400 baud.
e) Write a program to convert FFH hexadecimal number to decimal.

2. a) State characteristics of RISC and CISC architecture. 08
b) Write a program and draw flow chart to add the first ten natural numbers using 8051 microcontroller. 08
c) Draw PCA Timer/Counter Control Register (CCON) format and state each pin function. 04

3. a) State the features of advanced MCS251 microcontroller. 08
b) Draw interfacing of ADC and temperature sensor with 8051 microcontroller and write a program to read temperature, convert it to decimal and put it an P0 with some delay. 12

4. a) A square wave is being generated at pin P1.2. This square wave is to be sent to a receiver connected in serial form to this 8051. Write a program to do this. 10
b) Draw the diagram to interface external RAM and ROM with 8051 microcontroller. Mention the pins during interfacing and describe in brief. 10

[TURN OVER]

Q. P. CODE : 597502

5. a) How do you explain with diagram to interface a dc motor with 8051 microcontroller and also write an 8051 program to run the dc motor in both forward and reverse direction with delay? 10

   b) The word "RAJ" is to be burned in the flash ROM location starting from 0400H of microcontroller. Write a program to do this and to read this data into internal RAM locations starting from 60H. 10

6. a) Draw and explain internal port0 structures of 8051 microcontroller. 06

   b) Draw complete circuit diagram for interfacing the LCD module to 8051 μc. State steps for sending data to the LCD module. 06

   c) Assume that bit P2.2 is used to control an outdoor light and bit P2.5 a light inside a building. Write a program to turn on the outside light and turn off the inside one. 08

QP Code : 597700

(3 Hours) **[Total Marks : 80**

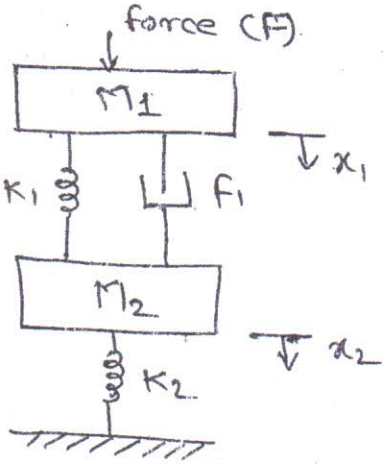
N.B. : (1) Question No. **1** is compulsory
(2) Attempt **any three** questions out of remaining **five** questions.
(3) Assume suitable data if necessary.

1. Attempt the following :- **20**
(a) Construct state model for the following differential equation.

$$\frac{d^3y}{dt^3}+3\frac{d^2y}{dt^2}+2\frac{dy}{dt}=\frac{du}{dt}+u$$

(b) Differentiate between lead, lag and lag-lead compensator.
(c) What are the limitations of transfer function. How those can be overcome by state variable analysis.
(d) Explain the need of compensator.

2. (a) Construct state model of the given mechanical system. **10**



(b) Given the system. **10**

$$\dot{x}=\begin{bmatrix}-4 & 3\\ -6 & 5\end{bmatrix}x$$

Determine eigen values and eigen vector of matrix A. Also find state transition matrix using cayley Hamilton method.

[TURN OVER]

QP Code : 597700

3. (a) Design lag-lead compensator using root locus technique. **10**

   (b) A unity feedback system with an open loop transfer function **10**

$$G(s)=\frac{k}{s(s+1)}$$

Design a suitable compensator to meet the following specifications.
Velocity error constant (K_v)=12/sec phase Margin (ϕ_m)=40°

4. (a) Explain Ziegler Nicholos tunning rules for tuning of PID controller. **10**

   (b) Find f (A) = e^{At} for ,

$$A=\begin{bmatrix}0 & 1\\ -2 & -3\end{bmatrix}$$

5. (a) Obtain the M matrix and Diagonal Matrix, **10**

Where, $A=\begin{bmatrix}0 & 1 & 0\\ 0 & 0 & 1\\ 8 & -12 & 6\end{bmatrix}$

   (b) Explain design procedure of lead compensator using Bode Plot. **10**

6. (a) For a regulator system the plant is given by $\dot{x}=Ax+BU$. **10**

Where $A=\begin{bmatrix}0 & 1 & 0\\ 0 & 0 & 1\\ -1 & -5 & -6\end{bmatrix}$ $B=\begin{bmatrix}0\\ 0\\ 1\end{bmatrix}$

The system uses state feedback control u = - Kx. Desired closed loop poles are at S= - 2±j4, -10.
Determine state feedback gain matrix K.

   (b) A unity feedbac type-2 system with $G(s)=\frac{K}{s^2}$. It is desired to compensate the system so as to meet the following transient response specifications **10**

$Ts \leq 4$ sec

$\%Mp \leq 20\%$

E-/Sem-V/ -INST/ T3425 / T0503 SIGNAL CONDITIONING CIRCUIT DESIGN / MAY-2017
(CBSGS)

Q.P. Code : 597602

3 Hours [Total Marks : 80

Note : 1. Question no. 1 is compulsory

2. Attempt any three questions from remaining five questions

3. Assume suitable data whenever necessary

Q.1. a. Draw and explain circuit diagram of peak detector. 20

b. Explain lead compensation in bridge.

c. A bridge circuit has R1 = R2= R3 =2kΩ and R4= 2.05Ω resistances and a 5V supply. If a galvanometer with a 50Ω internal resistance is used for a detector, find the offset current.

d. Explain the significance of all-pass filters.

Q.2. a. What is the need for 3 op-amp instrumentation amplifier? Mention the applications of instrumentation amplifier. Explain any one in detail. 10

b. Draw and explain circuit diagram of precision rectifier circuit using op-amp. Discuss its advantages over traditional diode rectifier. 10

Q.3. a. Draw and explain circuit for ideal differentiator with waveforms. Discuss the problems associated with ideal integrator and draw the circuit diagram for practical differentiator. 10

b. What are the advantages of active filters over passive filters. Design a second-order high pass filter at a high cut-off frequency of 1kHz. 10

Q.4. A CdS cell has a dark resistance of 100kΩ and a resistance in a light beam of 30kΩ.The cell time constant is 72ms. Devise a system to trigger a 3-V comparator within 10ms of the beam interruption. 10

b. Draw and explain the principle and construction of metal strain gauges. What is the signal conditioning associated with it. 10

Q.5. a. Explain the following terms : 10

(i) Signal level and bias changes

(ii) Filtering and impedance matching

(iii) Linearization

(iv) Concept of loading

b. A sensor outputs a voltage ranging from -2.4 to -1.1V. For interface to an analog-to-digital converter, this needs to be 0 to 2.5V. Develop the required signal conditioning. 10

Q.6. **Write short notes on : (any four)** 20

a. **Sample and hold circuit**

b. **Phase Locked loop**

c. **IC 555 timer**

d. **Data Acquisition System**

e. **A to D converters**

f. **SMPS**

INST / Sem-V (CBSGS) / Control System Components / May-17

QP Code : 597400

(3 Hours) **[Total Marks : 80**

N.B. : (1) Question No.1 is compulsory
(2) Attempt any three questions from remaining five questions.
(3) Draw neat diagrams wherever required.
(4) Assume suitable data if required.

1. Solve any **Five.** **20**
(A) Explain Flapper Nozzle Systems.
(B) List out various pneumatic and hydraulic system components.
(C) Give difference between two wire and four wire transmitter.
(D) Describe working of pinch valve.
(E) Explain working of Alarm Annunciator.
(F) Explain any one application of RFID system.

2. (A) List out speed control circuits for hydraulic actuator. Explain any one of them with neat diagram. **10**
(B) What is necessity of pressure regulating valve in pneumatic system. Explain relieving pressure regulating valve in details. **10**

3. (A) Explain desirable features of SMART transmitter. **10**
(B) Why valve positioner is necessary? Explain force balance valve positioner with diagram. **10**

4. (A) Explain control valve actuators in details. **10**
(B) Compare: pneumatic, hydraulic and electric systems. **10**

5. (A) What are control relays? Explain electromechanical relay and reed relay with their specifications. **10**
(B) Write a short note on pneumatic controller. **10**

6. Write short notes on: **20**
(A) Selection criterion of control valve.
(B) Synchros.
(C) Pneumatic temperature Transmitter.
(D) Pneumatic to electric converter.
